DIRECT REMOTE ANALOG/DIGITAL PRINTING DEVICES, PROCESSES AND MEDIUMS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation-in-part of application no. PCT/US04/10128 filed Mar. 31, 2004, which application claims priority (pursuant to 35 U.S.C. § 119 (e)) to the filing date of the U.S. Provisional Patent Application Ser. No. 60/459,499 filed Mar. 31, 2003; the disclosures of which applications are herein incorporated by reference.

BACKGROUND

[0002] In many cases it is desirable to remove restrictions placed on existing analog and digital printing process. For example, printing processes are restricted to a continuous linear motion. Digital print heads are designed to function in a fixed position or to be moved from side-to-side, using precise mechanisms within a printing apparatus. In many cases it is not practical to bring fixed printing equipment to remote locations. Hand-held printers exist, but are typically a part of a compete unit such as a hand-held receipt generator.

[0003] In inventory control or at supermarkets, it would be desirable to have a remote digital printing process, which combines wireless communicated information, dating information and other relevant storage information on demand.

[0004] Most printing processes require flat planar surfaces for printing. Often it would be desirable to print on non-uniform compliant surfaces, rather than be restricted to common planar surfaces. For example, packages are often folded or creased. Meat products in the dairy case usually have a non-planar surface.

[0005] In many instances it would be desirable to print on non-conventional surfaces to improve visual effects. Currently, there are no convenient digital processes and applicable printing mediums for directly printing on skin. It would be important in many cases to provide a convenient, cost effective, fast, and accurate means to alter skin conditions and improve both the visual appearance and healthiness of skin using a printing means.

SUMMARY OF THE INVENTION

[0006] Direct remote digital/analog printing devices and mediums have been developed, which are capable of directly digitally printing on non-uniform or uniform substrate/mediums. Examples of devices are also capable of recognizing wireless digital or analog signals for processing and printing or directly scanning substrates using information (analog or digitally) encoded. The read/write devices can be remote and operate separately or can be attached to existing communications devices and products.

[0007] Direct remote digital printing processes and compatible printing mediums capable of functioning with non-planar surfaces, capable of printing in multiple directions, and capable of producing high resolution printing results can find a multitude of uses not anticipated and not possible using conventional restricted printing processes and substrates.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] **FIG. 1** shows an analog color-shifting sketching device and printing medium. The device shown in **FIG. 1A** allows the user to create designs by manipulating a heating element with a pair of knobs. When the heating element is moved across a color-shifting medium, it creates designs such as those shown in **FIG. 1B**.

[0009] **FIG. 2** shows an example of thermochromic intrinsically colored imprint paper. Graphics may be hidden or obscured, and later revealed by exposure to heat, or images may be created by using a thermal printing element.

[0010] **FIG. 3A** shows a remote digital fingertip printer device. A modified thermal print head may be attached to the finger with adhesive and messages entered on an attached keypad. The device may then be used to print messages as it is moves across a color-shifting surface as shown in **FIGS. 3B, 3C**, and **3**D.

[0011] **FIGS. 4A and 4B** show a color-shifting medium applied to the skin. Once the medium has been applied to the skin, a device such as the fingertip printer shown previously may be used to print messages on it as shown in **FIGS. 4C, 4D**, **4**E, and **4**F.

[0012] **FIG. 5A** shows how a color-shifting medium applied to the skin may undergo a subsequent color change when exposed to temperatures above or below body temperature. **FIG. 5B** shows a red color caused by exposure to warm water, while **FIG. 5C** shows a purple color caused by exposure to cold water.

[0013] **FIG. 6A** shows a message formed by using the skin itself as a printing medium. The lettering is initially contrasted by the color-shifting medium, which may be washed off. Whether or not a color-shifting medium is used, the message printed on the skin will remain darker than the surrounding skin, as shown in **FIG. 6B**.

FEATURES OF THE INVENTION

[0014] The subject invention provides methods of printing on a substrate, where a feature of the methods is that a print head is moved across at least a portion of said substrate in an analog manner. In certain embodiments, the print head is moved across the substrate in a manner that varies with respect to at least the x direction. In certain embodiments, the print head is moved across the substrate in a manner that varies with respect to both the x and y directions. In certain embodiments, the print head is moved across the substrate in a manner that varies with respect to rate in at least one of the x and y directions. In certain embodiments, the print head is moved across the substrate in a manner that varies with respect to rate in both of the x and y directions. In certain embodiments, the print head is moved across the substrate in a non-linear manner. In certain embodiments, the print head is moved across the substrate in a curvilinear manner. In certain embodiments, the print head is manually moved across the substrate, either directly or indirectly. In certain embodiments, the print head is part of a device in which the print head has full range of motion in at least the x and y directions. In certain embodiments, the print head is part of a device in which the print head has full range of motion in the x, y and z directions. In certain embodiments, the print head is compliant.

[0015] In certain embodiments, the substrate is a non-uniform substrate. In certain embodiments, the print head is a not a fluid-deposition print head. In certain embodiments, the print head is part of a drawing device, e.g., a recreational